

# Development of Human-Centric Command And Control Requirements for the Operation of Autonomous Systems

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**Combat Direction Systems Activity**

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# Presentation Outline

- Problem statement
- Background
  - Vehicle platforms
  - Unmanned vehicle missions
- Mission characteristics: Present vs. Future
- Control system issues
- Command & Control issues
- Brain storming map
- Scenarios
- Chain of command issues
- Current and future hurdles
- Conclusions

# Problem Statement

Victory in a conflict is often determined by the combatant who best manages their available assets.

Question:

How do you manage all the information and resources associated with a large number of unmanned systems?



# UV Platforms

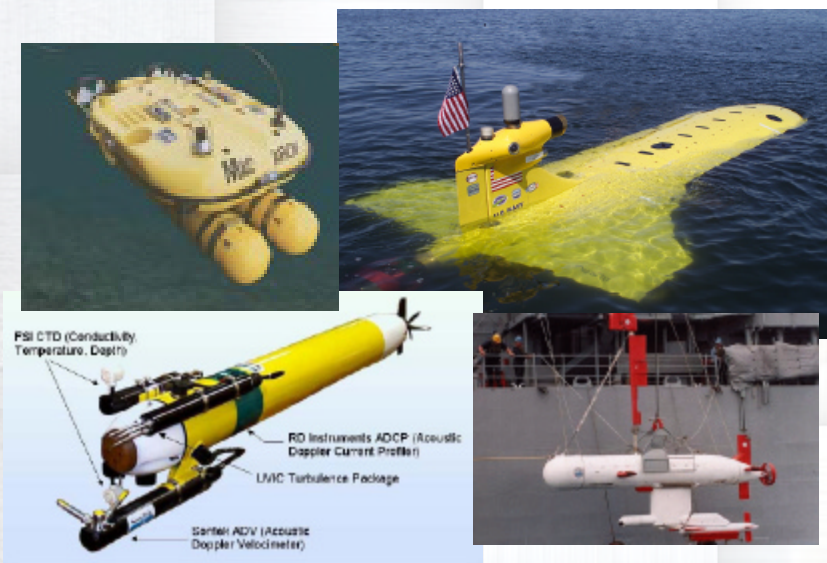
- Air (UAV)



- Ground (UGV)



- Underwater (UUV)



- Surface (USV)



# Missions

## Current and Future Unmanned Vehicle Missions

- Chemical/Biological/Nuclear Detection
- Surveillance
  - Visual
  - Infrared
  - Radar
  - Sound/Vibration
- Battle Damage Assessment
- Attack
- Force protection
- Mine detection/clearing
- Targeting
- Medical
- Logistics support
- Personnel transport/delivery
- Electronic warfare:
  - Countermeasures
  - Signal intelligence
  - Force deception
  - Over the horizon relays
- Special operations missions



# Present vs. Future

## Vehicle Management

- Present

- Single vehicles
- Single missions
- Diverse management systems

- Future

- Multiple vehicles
- Multiple missions
- Common management system

# Control Systems

## Migration to a Common Command & Control System/Combat Direction System

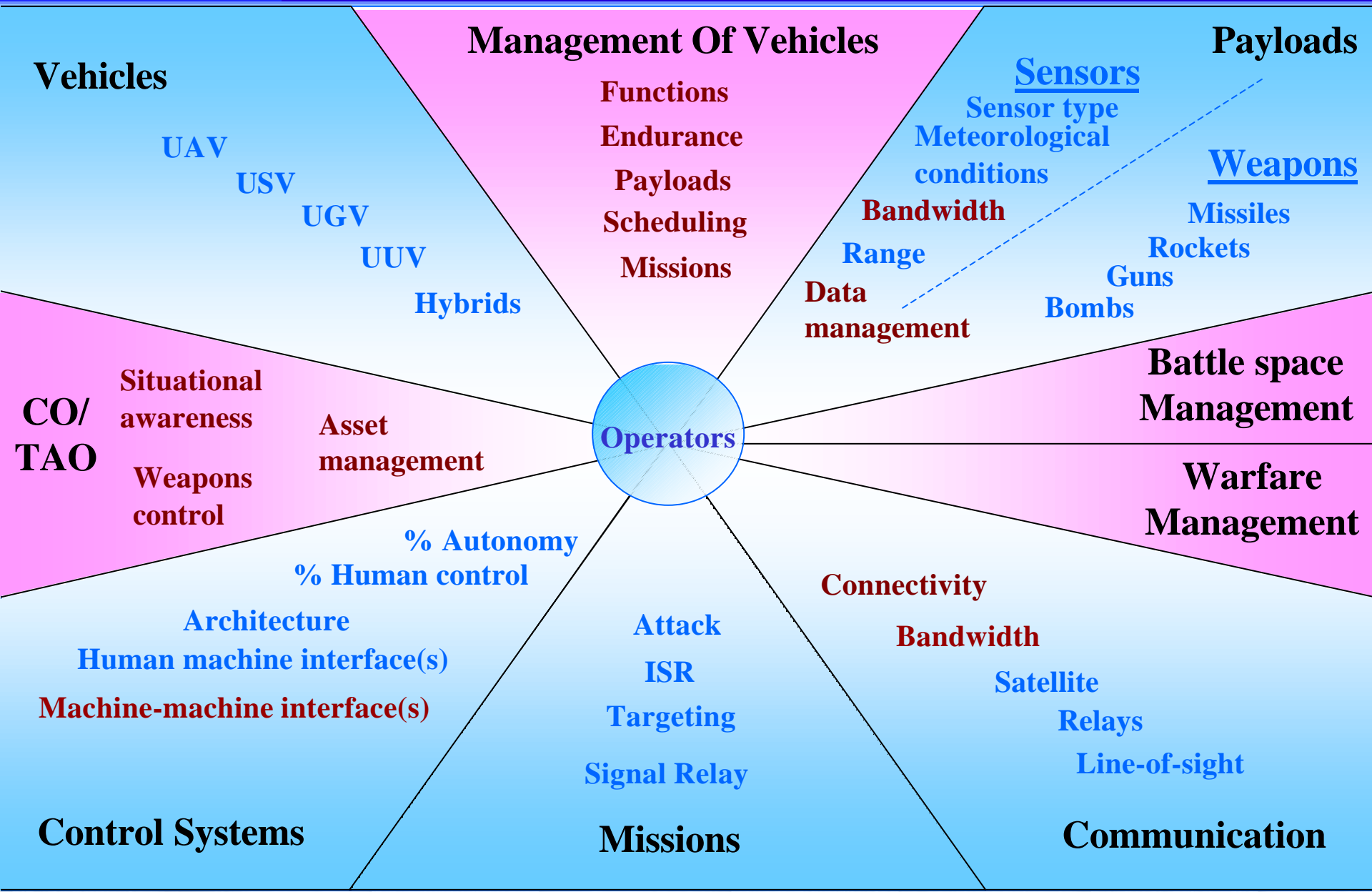
- Unmanned Vehicle Control Systems

- TCS
- TCDL
- ⋮

- Warfare Command & Control Systems

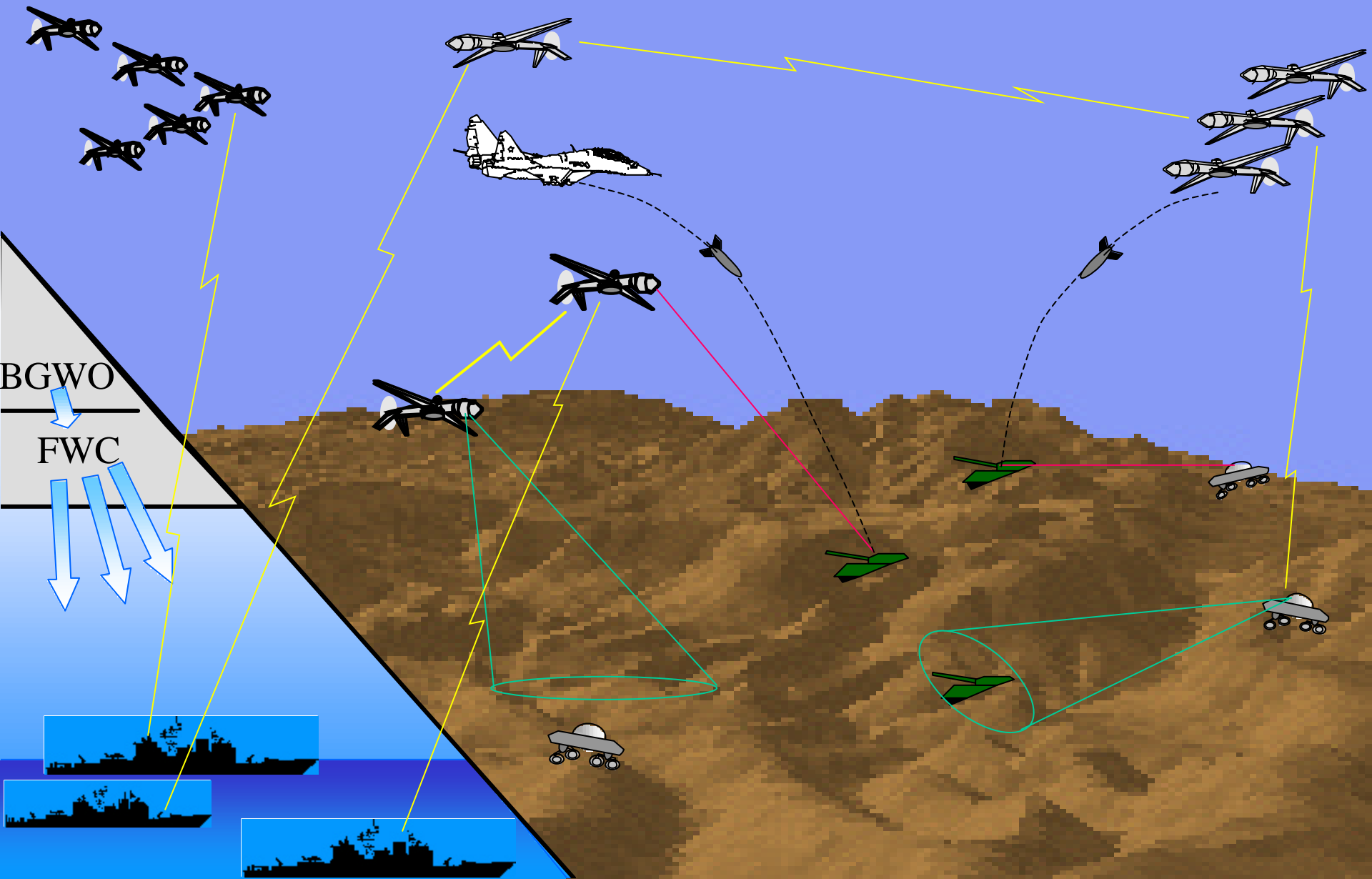
- AEGIS
- ACDS
- SSDS
- NTDS
- GCCS
- ⋮

# Brainstorm Map





# Example Scenario

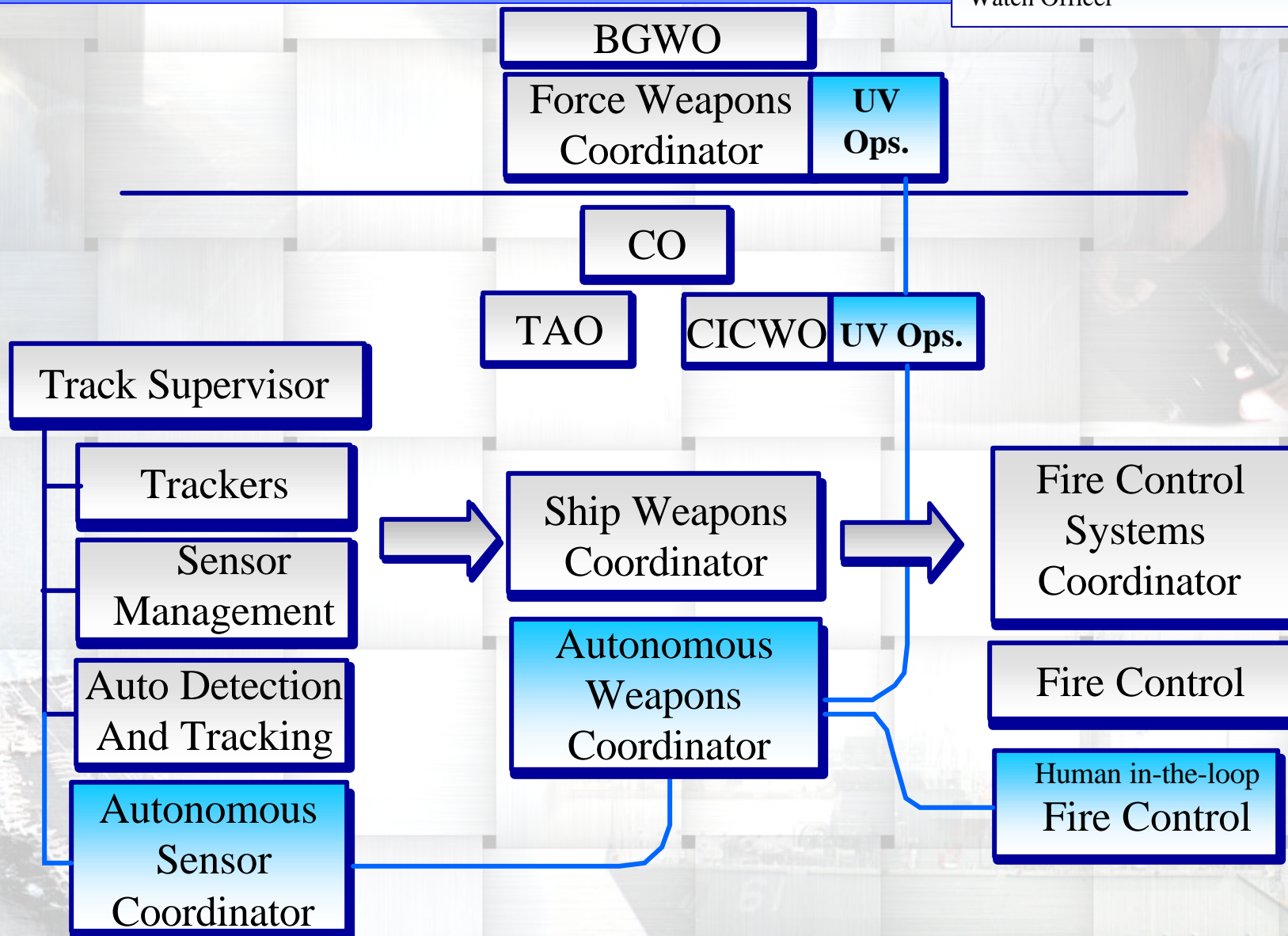


# Chain Of Command CG/DDG/FFG

**BGWO:** Battle Group Weapons Officer  
**TAO:** Tactical Action Officer  
**CO:** Commanding Officer  
**CICWO:** Combat Information Center  
Watch Officer

*Off Ship*

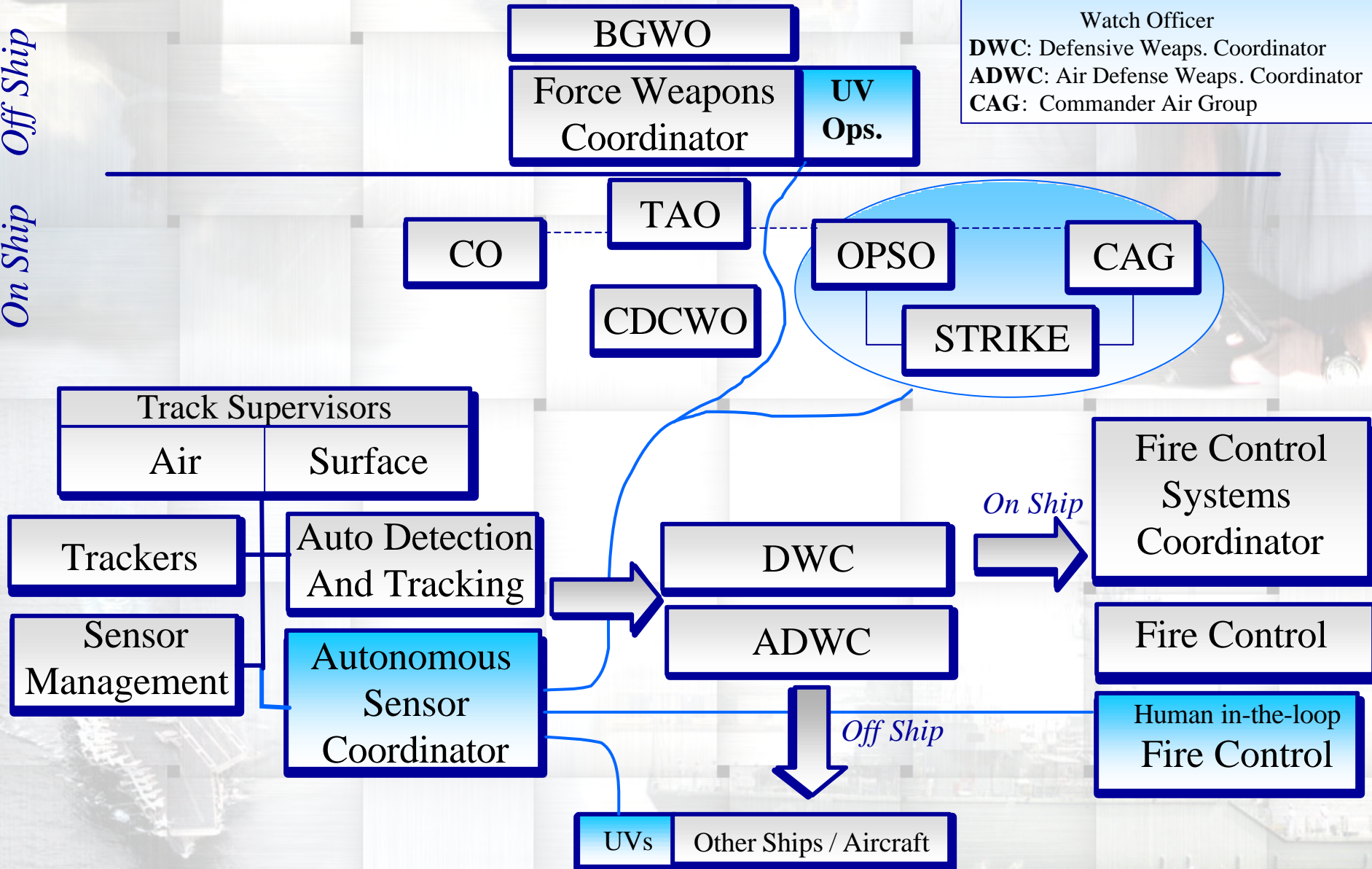
*On Ship*



# Chain Of Command CV/CVN

**BGWO:** Battle Group Watch Officer  
**TAO:** Tactical Action Officer  
**CO:** Commanding Officer  
**OPSO:** Operations Officer  
**CDCWO:** Combat Direction Center  
 Watch Officer  
**DWC:** Defensive Weaps. Coordinator  
**ADWC:** Air Defense Weaps. Coordinator  
**CAG:** Commander Air Group

*Off Ship*  
*On Ship*





# Hurdles

- Autonomy
- Political obstacles
- Inter-service coordination
- Unified & Universal Command & Control System
- Logistics
- Funding

# Conclusions

- A Concentration on human factors is necessary because of difficulty in managing such a diversity of assets
- The management system must be standardized, Inter-service coordination is necessary
- Current Command & Control model not satisfactory
- The current chain of command must be modified
- The management system must be ADAPTABLE because of changing levels of autonomy – currently one man/vehicle, next one man/10 vehicles and then one man/100 vehicles...
- A systems engineering solution is needed for this “System of Systems” problem and must be applied to the to the entire UV fleet

# Thank You for Your Attention

The Terminator is Coming!

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We Need to be Ready!

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"MAKING A DIFFERENCE IN FLEET READINESS -- TODAY AND IN THE  
FUTURE!"***